CHAPTER 5

Pharmacological values of *Mitragyna parvifolia* (True cadamba)

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Abstract: Pharmacology plays a vital role in drug discovery. Unlike other members of the *Mitragyna* genus, *Mitragyna parvifolia* contains various alkaloids that contribute to its pharmacological properties. Some of the significant alkaloids reported by many researchers include mitraphylline, rotundifoline, rhynchophyline, isorotundifoline, rhynchociline, mitragynine, and speciociliatine. It possesses some major pharmacological investigation such as analgesic, anti-arthritic, antipyretic, anti-inflammatory, and antinociceptive. The chapter summarises according to literature and field survey on the pharmacological values of *M. parvifolia*.

Keywords: Pharmacological values, active compounds, alkaloids, drug formulations

INTRODUCTION

Pharmacological activity deals with the beneficial or adverse effects of a drug on living matter. Among the various properties of chemical compounds, pharmacological play a crucial role since ages as they suggest uses of the compounds in medical applications. Plant secondary metabolites are broadly divided into three categories: terpenoids, alkaloids, and phenolics

(Ahmad et al., 2022). Each of these classes of secondary metabolites includes a huge array of compounds that have been found effective in treating different diseases. Some of these compounds are- atropine, codeine, morphine, and nicotine, coming under alkaloids; linalool comes under terpenoids, while flavonoids, lignans, and proanthocyanidins are categorized as phenolics. These bioactive phytochemicals are responsible for many pharmacological activities such as anti-inflammation, anti-cancer, anti-allergic, and antimicrobial activity **(Kaushik et al., 2021)**.

Mitragyna species are mostly trees or shrubs. Leaves are petioled; stipules large, caducous. Flowers crowded in globose, axillary, and terminal solitary or panicled, pedunculate heads, the receptacle. Mostly, in *Mitragyna* species contains indole alkaloids, and triterpenoid saponins were reported by many researchers for phytochemical investigations on *Mitragyna* genus isolation, and mitragynine, an indole alkaloid, was the major constituent of this plant, accounting for about half of the total alkaloid contents. Some of the *Mitragyna* species are used medicinally and also for fine timber purposes **(Jadhav et al., 2022)**. Some Mitragyna genus possess products to western markets. In ancient times, traditional healers used *Mitragyna speciosa* leaves, known as kratom, which have been used in herbal medicine by natives of Thailand and other regions of Southeast Asia as an herbal drug for decades. Traditionally, Kratom was mostly used as a stimulant by Thai and Malaysian labourers and farmers to overcome the burdens of hard work. Remarkably, in 2019, the United States Food and Drug Administration (FDA) reported that there is no specific evidence regarding its safety or effectiveness for any health condition **(Brown et al., 2017)**.

Mitragyna parvifolia (Roxb.) Korth. is a tree species that primarily grows in deciduous and evergreen forests. It is mostly distributed in Asia, native to India and Sri Lanka, Nepal, Pakistan, Indonesia, Myanmar, etc. According to some ancient literature, it was presumed to possess cultural values associated with Lord Krishna in Vridavana rather than the well-known tree *Neolamarkia cadamba*, which is a highly mistaken myth. Ecological significance it holds such as the caterpillars of the commander (*Limenitis procris*), a brush-footed butterfly as a food plant **(Jadhav et al., 2022)**.

A wide range of chemical constituents reported in the plant are pyroligneous acid, methyl acetate, ketones, and aldehydes **(Kaushik et al., 2009)**. As per phytochemical screening of the methanolic leaf extract revealed the presence of alkaloids, terpenoids, phenols, tannins, and flavonoids. It has been identified to possess 24 phytoconstituents, including the major

alkaloid mitraphylline **(Jebaseelan et al., 2024)**. Heteroyohimbinoid-type oxindole alkaloids from *M. parvifolia* **(Pandey et al., 2006)**. Mitragynine, a major indole-alkaloid, is isolated from leaves **(Gong et al., 2012)**. The leaves of the plant *M. parvifolia* have afforded two alkaloids, 16,17-dihydro-17β-hydroxy isomitraphylline and 16,17-dihydro-17β-hydroxy mitraphylline, together with two known alkaloids, isomitraphylline, dihydrocorynantheol, dihydrocorynantheol N-oxide, akuammigine, akuammigine N-oxide, rotundifoline, speciophylline N-oxide, uncarine F, uncarine, F N-oxide, and mitraphylline. The aerial parts, stem, bark, and roots of the tree contain indolic (tetrahydroalstonine, akkyamigine, hirsuteine, etc.) and oxiindollic alkaloids **(Pandey et al., 2006; Ahmad et al., 2022; Jadhav et al., 2022)**.

It possesses a wide range of traditional uses of *M. parvifolia*. In Karnataka, fresh leaf sap is used by the tribals to cure jaundice. In Uttar Pradesh, the tribals of Sonaghati used the bark decoction to treat fever. In Tamil Nadu, the stem bark is used for rheumatic pain. Leaves are used to treat jaundice, fever, muscular pain, colic pain, wounds, and ulcers **(Gong et al., 2012)**. The bark and root are used to treat rheumatic pain, burning sensation, gynaecological disorders, cough, and oedema. Fruit possess galacto-depurant properties. Leaves are used to treat lymphatic filariasis **(Jebaseelan et al., 2024)**. *M. parvifolia* and its active compounds possess wide-reaching pharmacological actions, including antitumor, cardiovascular disease, and antibacterial activity **(Gong et al., 2012)**.

METHODOLOGY

The survey was carried out based on field and literature surveys. The field survey was carried out to collect photographs of the plant from 2022-2024 in Odisha state. The plant was identified by the authors in the field, followed by flora books **(Saxena and Brahmam, 1995)**. The literature survey was carried out through websites like PubMed, Scopus, and Web of Science. Relevant articles and published books were selected for the review process.

MORPHOLOGY

It is a moderate-sized deciduous tree, bark light grey, smooth. Leaves broadly elliptic or obovate, obtuse, sometimes rounded and shortly cuspidate, glabrous except near the axils of the 7-10 prominent secondary nerves, base rounded or cuneate; petiole 1.3-4.7 cm; stipules oblong, keeled, covering the buds and falling on their expansion. Heads of flowers 3 cm diam. 1-2.5 together on a short lateral axillary branch or peduncle bearing two pale-coloured leaves or bracts near the summit, persisting more or less in fruit. Flowers white, narrowly funnel–

shaped; bracteoles clavate. Fruiting heads 1.4-1.9 cm across. Capsule ellipsoid, verrucose **(Saxena and Brahmam, 1995; Figure 1-3)**.



Figure 1: Whole plant of *M. parvifolia*



Figure 2: Leaves of *M. parvifolia*



Figure 3: Flower of *M. parvifolia*

PHARMACOLOGICAL VALUES

Researchers reported certain kinds of compounds which is responsible for certain kinds of pharmacological incidents. The leaves of the plant *M. parvifolia* have afforded two alkaloids, 16,17-dihydro-17b-hydroxyisomitraphyline and 16,17-dihydro-17b-hydroxymitraphylline, together with two known alkaloids, isomitraphylline and mitraphylline. Some of these alkaloids, particularly mitraphyline and mitragynine, possess a local anaesthetic activity **(Vishal and Sanjay, 2010)**. Researchers studied the extracts of *M. parvifolia*, particularly ethanolic and methanolic extracts, which exhibit antimicrobial activity against certain bacterial strains, which practically suggested the potential uses in developing a novel antimicrobial agent **(Jebaseelan et al., 2024)**. A range of indolic and oxindolic alkaloids including dihydrocorynantheol, akuammigine, mitraphylline, and rhynchophylline. have been reported from *M. parvifolia* leaves and stem barks and functional properties such as analgesic, antiarthritic, antipyretic, anti-inflammatory, antinociceptive, anticonvulsant, anxiolytic, anthelmintic, antimicrobial, antiproliferative and antioxidant activity **(Choudhary and Jain, 2016; Kaushik et al., 2009; Table 1)**. The ethanolic extract of *M. parvifolia* fruit has been confirmed to possess anthelmintic activity **(Mandrupkar et al., 2017)**. Due to its vast importance in every aspect of medicinal, cultural, industrial value and ecological significance, the population of this species in some places becomes endangered. However, due to such status, it is propagated through various means through micropropagation to attain pharmaceutical value **(Patel et al., 2020)**.

Table1: Pharmacological values of *Mitragyna parvifolia*

Plants parts	Pharmacological values	Sources
Leaves	Antiarthritic	Choudhary and Jain, (2016)
Leaves	Antipyretic	Choudhary and Jain, (2016); Sahu and Roy, (2008)
Leaves	Anti-nociceptive	Choudhary and Jain, (2016); Gong et al., (2012); Gupta et al., (2009)
Leaves	Anti-inflammatory	Choudhary and Jain, (2016); Gupta et al., (2009)

Fruit	Anti-inflammatory, antimicrobial, and analgesic	Saneja et al., (209)
Leaves	Anticonvulsant	Choudhary and Jain, (2016); Kaushik et al., (2009)
Stem and bark	Anxiolytic	Choudhary and Jain, (2016); Jadhav et al., (2022)
Stem and bark	Anthelmintic activity	Choudhary and Jain, (2016); Gong et al., (2012); Vishal and Sanjay, (2010); Sahu et al., (2009)
Fruit	Anthelmintic activity	Mandrupkar et al., (2017)
Bark and leaves	Antioxidant	Choudhary and Jain, (2016); Gong et al., (2012)
Leaves	Antibacterial	Jebaseelan et al., (2024); Kaushik et al., (2009)
Stem bark	Anticancer	Kumar et al., (2021)
Leaves	Analgesic and antimicrobial activity	Kaushik et al., (2009)
Bark and leaves	Antiproliferative	Jadhav et al., (2022)
Root	Anti-hypertensive activity	Jadhav et al., (2022)
Leaves	Antifungal	Padmavathi, (2021)

According to the researchers, a range of indolic and oxindolic alkaloids has been reported from *M. parvifolia* leaves and stem barks, which includes dihydrocorynantheol, akuammigine, mitraphylline, and rhynchophylline **(Ahmad et al., 2022)**. Mitraphylline is responsible for anti-inflammatory, antiproliferative, and anticancer activities **(Rojas-Duran et al., 2012; Gimenez et al., 2010)**. Akuammigine is responsible for anti-adrenergic and antimalaria

activities. Dihydrocorynantheol is responsible for insecticidal and anti-inflammatory activity **(Hennessy et al., 2024; Duwiejua et al., 2002; Rattan, 2010; Pozzatti et al., 2013)**. Rhynchophylline is responsible for neuroprotective, antihypertensive, and anti-inflammatory activities **(Geetha and Ramachandran, 2021; Chen et al., 2024)**.

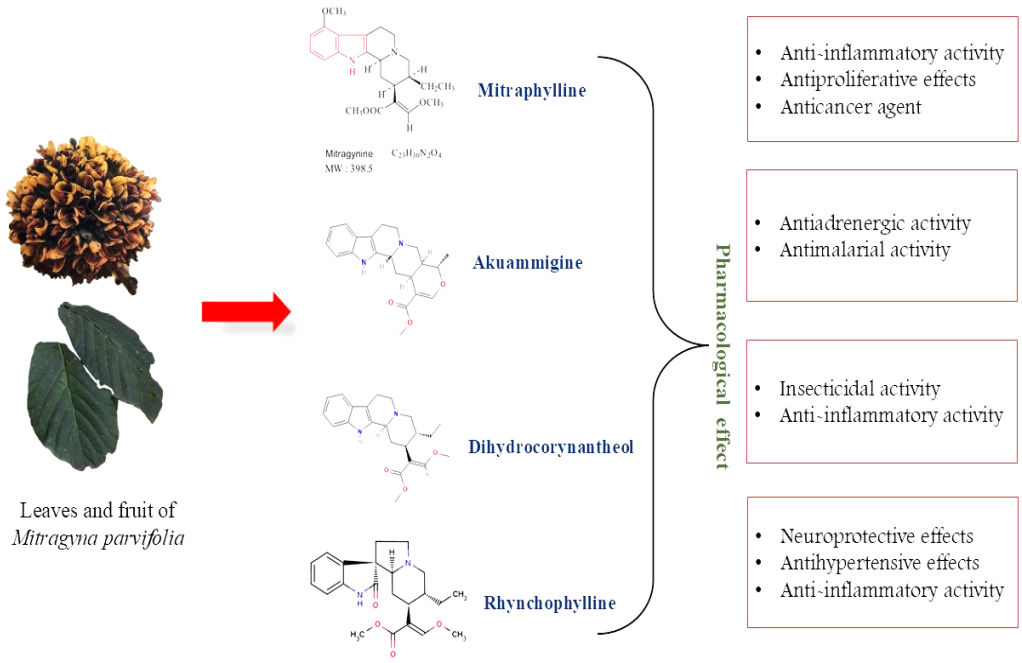


Figure 4: Pharmacological effect of *M. parvifolia*

CONCLUSION

According to literature and field surveys, it concludes that *Mitragyna parvifolia* exhibits a wide range of potential pharmacological activities (**Figure 4**). Many tribal communities heal common ailments like fever, stomach ache, and wounds. Mostly leaves, stems, bark, and root contain major kinds of alkaloid compounds. The various presence of alkaloids is likely responsible for the pharmacological effects. More comprehensive scientific studies are needed to fully elucidate the mechanisms of action and therapeutic efficacy of *M. parvifolia*.

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